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MOST COMMON ERRORS IN COMPANY VALUATION

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Abstract

This paper contains a collection and a classification of the 12 most common errors seen in company valuations performed by financial analysts, investment banks and financial consultants. The author had access to most of the valuations that are referred to in this paper when consulting in purchases, sales and mergers of companies, and in arbitrage processes. Some of the errors belong to public reports of financial analysts.

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MOST COMMON ERRORS IN COMPANY VALUATION

Introduction

This paper contains a collection and a classification of the 12 most common errors seen in company valuations performed by financial analysts, investment banks and financial consultants. The author had access to most of the valuations that are referred to in this paper when consulting in purchases, sales and mergers of companies, and in arbitrage processes. Some of the errors belong to public reports of financial analysts.

The errors are:

1. Wrong beta used for the valuation
   - 1.1. Using the historical industry beta, or the average of the betas of similar companies, when the result goes against common sense.
   - 1.2. Using the wrong formulae to lever and unlever the beta.
   - 1.3. When valuing an acquisition, using the beta of the acquiring company.
2. Wrong calculation of WACC.
3. Wrong calculation of the value of tax shields.
4. Wrong treatment of country risk
   - 4.1. Not considering the Country Risk, arguing that it is diversifiable.
   - 4.2. Assuming that a disaster in an emerging market will increase the calculated beta, in relation to the S&P 500, of the country's companies.
   - 4.3. Assuming that the beta calculated from historical data captures the country risk.
5. Wrong calculation of the cash flows
   - 5.1. The free cash flow and the equity cash flow do not satisfy $ECF = FCF + \Delta D - Int\ (1\text{-}T)$.
   - 5.2. Considering an increase in the company's cash position or financial investments as an equity cash flow.
   - 5.3. Expected Equity Cash flows are not equal to expected dividends plus other payments to shareholders (share repurchases…).
   - 5.4. Forgetting balance sheet accounts that affect the cash flows.
   - 5.5. Exaggerated optimism when forecasting the cash flows.
   - 5.6. Not considering cash flows resulting from future investments.
6. Errors when valuing seasonal companies.

7. Errors in the calculation of the residual value.

8. Errors when using multiples.

   8.1. Using the average of multiples extracted from transactions executed over a very long period of time, and/or the average of transactions multiples that have a wide dispersion.
   8.2. Using a multiple from an extraordinary transaction.
   8.3. Using ad hoc valuation multiples that go against common sense.

9. Time-value inconsistencies.

10. Including the value of real options that have no economic meaning.

11. Arguing that different discounted cash flow methods provide different valuations.

12. Asserting that "the valuation is a scientific fact, not an opinion."

1. Wrong beta used for the valuation

1.1. Using the historical industry beta, or the average of the betas of similar companies, when the result goes against common sense.

The following example comes from a report written by a financial consulting firm. "The purpose of our study has been to make a professional estimate of the fair value at 31 December 2001 of the shares of Inmosev, an unlisted real estate firm whose main business consists of buying land and building houses for resale. We have assumed a capital contribution by a third party in the amount of 30 million euros in the year 2002, with an estimated return on its investment of 20%; that is, 6 million euros.

"Our study is based essentially on information provided to us by Inmosev, consisting of historical data, and on assumptions and hypotheses about estimated future income over the next 11 years.

"Table 1 shows the equity cash flows that have been used in this study. The main assumptions and estimates made in applying the valuation method mentioned above are as follows:

Growth rate of the equity cash flows after 2012 = 1%.

Discount rate. The cost of equity corresponds to the return on long-term risk-free assets, plus the market risk premium, multiplied by a coefficient called beta:

Return on Spanish 15-year government bonds (risk-free return) = 5.00%

Market risk premium = 4.50% (Source: BNP Paribas, SCH)

Unlevered beta (ßu) = 0.27. Average of the unlevered betas of listed companies in Spain (see Table 2)

Levered beta (ßL) according to Inmosev's (average) capital structure = 0.50

The average cost of equity is 7.25%.

Consequently, the value of Inmosev's shares at 31 December 2001 is on the order of approximately 143.09 million euros."

Table 1. Main magnitudes of the Inmosev valuation

	Equity cash flow (ECF)	**ßu**	**Ku**	**ßL**	**Ke**	**Present value of ECF**
2001	0	0.27	6.22%			0
2002	-30,000	0.27	6.22%	0.45	7.04%	-28,026
2003	0	0.27	6.22%	0.42	6.91%	0
2004	0	0.27	6.22%	0.5	7.26%	0
2005	0	0.27	6.22%	0.52	7.35%	0
2006	0	0.27	6.22%	0.53	7.37%	0
2007	0	0.27	6.22%	0.57	7.55%	0
2008	5,631	0.27	6.22%	0.59	7.67%	3,437
2009	6,401	0.27	6.22%	0.56	7.54%	3,633
2010	7,184	0.27	6.22%	0.54	7.43%	3,796
2011	7,963	0.27	6.22%	0.52	7.32%	3,920
2012	20,501	0.27	6.22%	0.49	7.23%	9,412
Present value of cash flows from 2013 onward						152,913
					Sum	149,085

From this total we must deduct the margin that the new shareholder who contributes the 30 million euros will earn on the deal (we estimate a figure of around 6 million).

Table 2. Betas of listed real estate firms in Spain

	Vallehermoso	Colonial	Metrovacesa	Bami	Urbis	average
Levered beta	0.49	0.12	0.38	0.67	0.42	0.42
Unlevered beta	0.29	0.11	0.27	0.39	0.28	0.27

Source: Average of the unlevered betas, provided by SCH, of the real estate companies Vallehermoso, Colonial, Metrovacesa, Bami and Urbis.

Error. The resulting unlevered beta (0.27) is so small that it makes no sense to use it to value any company, let alone an unlisted one. Also, these betas (and any others that might have been used) are arbitrary, as Table 3 shows. If we calculate the betas of the five companies on 31 December 2001 using daily and monthly data and different periods, we can obtain average unlevered betas ranging anywhere from 0.22 to 0.85. Obviously, having a valuation that depends on such a shifting and unreliable variable is contrary to all common sense and prudence.

Table 3. Betas calculated at 31 December 2001, with respect to the Madrid Stock Exchange General Index, using daily and monthly data for different periods prior to 31/12/2001

		Beta at 31/12/2001					
Period	Data	Vallehermoso	Colonial	Metrovacesa	Bami	Urbis	Average
	Daily	0.70		0.46	0.67	0.58	0.60
5 years	Monthly	0.71		0.45	1.25	1.00	0.85
	Daily	0.67		0.41	0.63	0.59	0.58
4 years	Monthly	0.58		0.43	0.95	0.80	0.69
	daily	0.60		0.31	0.51	0.48	0.48
3 years	monthly	0.41		0.17	0.59	0.42	0.40
	Daily	0.42	0.15	0.19	0.27	0.25	0.26
2 years	Monthly	0.68	0.28	0.50	0.85	0.67	0.60
	Daily	0.37	0.18	0.18	0.19	0.27	0.24
1 year	Monthly	0.59	0.41	0.46	0.32	0.78	0.51
	Daily	0.31	0.23	0.22	0.09	0.25	0.22
6 months	Monthly	0.81	0.72	0.68	0.39	0.80	0.68
	Maximum	0.81	0.72	0.68	1.25	1.00	0.85
	Minimum	0.31	0.15	0.17	0.09	0.25	0.22

In the end, the shares were sold for 70.4 million euros (instead of 143 million). This is the figure obtained by discounting the flows shown in Table 1 at 9.8% (rather than at 7.26%).

Historical betas change dramatically, as shown in Fernández (2004b), who reports betas of 3,813 companies calculated each day of December 2001 and January 2002, using 60 monthly returns. The maximum beta of a company was, on average (median), 15.7 (3.07) times its minimum beta. The median of the percentage daily change (in absolute value) of the betas was 20%. This paper and Damodaran (2001, page 72) also show that the calculated betas change dramatically and that they depend very much on the period used to estimate the beta.

1.2. Using the wrong formulae to lever and unlever the beta.

Fernández (2002, page 506) shows six different formulae for levering and unlevering the beta. Only two of them are correct, as shown in Fernández (2004c):

- If the company expects to increase its debt, the correct relationship between the levered beta ($ß_L$) and the unlevered beta (ßu) is: $ß_L = ßu + (ßu - ßd)\ D\ (1 - T) / E$.
- If the company will not increase its debt, the correct relationship between the levered beta ($ß_L$) and the unlevered beta (ßu) is: $ß_L = ßu + (ßu - ßd)\ (D - VTS) / E$.

Other wrong relationships are:

Damodaran (1994): $ß_L = ßu + ßu\ D\ (1 - T) / E$
Practitioners: $ß_L = ßu + ßu\ D / E$

Harris-Pringle (1985), Ruback (1995 and 2002): $ß_L = ßu + (ßu – ßd)\ D / E$
Miles-Ezzell (1980): $ß_L = ßu + (ßu – ßd)\ (D / E)\ [1 – T\ Kd / (1+Kd)]$

1.3. When valuing an acquisition, using the beta of the acquiring company

From an analyst's report: "As the target company is much smaller than the bidder, the target company will have almost no influence on the resulting capital structure and the riskiness of the resulting company. Therefore, the relevant beta and the relevant capital structure for the valuation of the target company are those of the acquiring company." Wrong, the relevant risk is the risk of the acquired assets. If that was not the case, a Government Bond should have a different value for every company.

2. Wrong calculation of WACC

In many valuations, the debt to equity ratio used to calculate the WACC is different from the debt to equity ratio resulting from the valuation.

An example is the valuation of a Broadcasting Company performed by an investment bank (see Table 4), discounting the expected FCFs at the WACC (10%) and assuming a constant growth of 2% after 2008. The valuation provided lines 1 to 7, and stated that the WACC was calculated assuming a constant Ke of 13.3% (line 5) and a constant Kd of 9% (line 6). The WACC was calculated using market values (the equity market value at the valuation date was 1,490 million and the debt value 1,184) and the statutory corporate tax rate of 35%.

The valuation also included the Equity value at the end of 2002 (3,033; line 8) and the debt value at the end of 2002 (1,184; line 10). Table 5 provides the main results of the valuation according to the investment bank.

Errors

a. Wrong calculation of the WACC. For calculating the WACC, we must know the evolution of the Equity value and the Debt value. We calculate the Equity value based on the equity value provided for 2002. The formula that relates the equity value in one year with the equity value in the previous year is $E_t = E_t\text{-}1\ (1+Ke_t) - ECF_t$.

   To calculate the debt value, we may use the formula for the increase of debt that appears on line 9. The increase of debt may be calculated if we know the ECF, the FCF, the interest, and the effective tax rate. With line 9, it is easy to fill line 10.

   Line 11 shows the debt ratio according to the valuation, which decreases with time.

   If we calculate the WACC using lines 4, 5, 6, 8 and 10, we get line 12. The calculated WACC is higher than the WACC assumed and used by the valuer.

   Another way of showing the inconsistency of the WACC is to calculate the implicit Ke in a WACC of 10%, using lines 4, 6, 8 and 10. This is shown in line 13. Ke should be much lower than 13.3% for using a WACC of 10%.

b. The capital structure of 2008 is not valid to calculate the residual value because to calculate the present value of the FCF growing at 2% using a single rate, there has to be a constant debt to equity ratio.

Table 4. Valuation of a Broadcasting Company performed by an investment bank

Data provided by the investment bank in italics.

		2002	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**
1	FCF		*-290*	*-102*	*250*	*354*	*459*	*496*
2	ECF		*0*	*0*	*0*	*0*	*34*	*35*
3	Interest expenses		*107*	*142*	*164*	*157*	*139*	*112*
4	Effective tax rate		*0.0%*	*0.0%*	*0.0%*	*0.0%*	*12.0%*	*35.0%*
5	Ke		*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*	*13.3%*
6	Kd		*9.0%*	*9.0%*	*9.0%*	*9.0%*	*9.0%*	*9.0%*
7	WACC used in the valuation		*10.0%*	*10.0%*	*10.0%*	*10.0%*	*10.0%*	*10.0%*
8	Equity value (E)	3,033	3,436	3,893	4,410	4,997	5,627	6,341
9	ΔD = ECF - FCF + Int (1-T)		397	244	-86	-197	-303	-389
10	Debt value (D)	1,184	1,581	1,825	1,739	1,542	1,239	850
11	D/(D+E)	28.1%	31.5%	31.9%	28.3%	23.6%	18.0%	11.8%
12	WACC using lines 4,5,6,8,10		12.09%	11.95%	11.93%	12.08%	12.03%	11.96%
13	Implicit Ke in a WACC of 10%		10.39%	10.46%	10.47%	10.39%	10.64%	10.91%

Table 5. Valuation using the wrong WACC of 10%

Present value in 2002 using a WACC of 10%	
Present value in 2002 of the free cash flows 2003-2008	647
Present value in 2002 of the residual value (g=2%)	3,570
Sum	4,217
Minus debt	-1,184
Equity value	3,033

To perform a correct valuation, assuming a constant WACC from 2009 on, we must recalculate Table 4. Tables 6 and 7 contain the valuation correcting the WACC. To assume a constant WACC from 2009 on, the debt must also increase 2% per year (see line 9, 2009). This implies that the ECF (line 2) in 2009 is much higher than the ECF of 2008.

Just by correcting the error in the WACC, the equity value is reduced from 3,033 to 2,014 (a 33.6% reduction).

Table 6. Valuation calculating the WACC correctly

		2002	2003	2004	2005	2006	2007	2008	2009
1	FCF		-290	-102	250	354	459	496	505.9
2	ECF		0	0	0	0	34	35	473.2
3	Interest expenses		107	142	164	157	139	112	76.5
4	Effective tax rate		0.0%	0.0%	0.0%	0.0%	12.0%	35.0%	35.0%
5	Ke		13.3%	13.3%	13.3%	13.3%	13.3%	13.3%	13.3%
6	Kd		9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
8	Equity value (E)	2,014	2,282	2,586	2,930	3,320	3,727	4,187	4,271
9	ΔD = ECF - FCF + Int (1-T)		397	244	-86	-197	-303	-389	17
10	Debt value (D)	1,184	1,581	1,825	1,739	1,542	1,239	850	867
11	D/(D+E)	37.0%	40.9%	41.4%	37.2%	31.7%	25.0%	16.9%	16.9%
12	WACC calculated with 4,5,6,8,10		11.71%	11.54%	11.52%	11.70%	11.59%	11.44%	12.04%

Table 7. Valuation using the corrected WACC from Table 6

Present value in 2002 using the WACC calculated in Table 6	
Present value in 2002 of the free cash flows 2003-2008	588
Present value in 2002 of the residual value (g=2%)	2,610
Sum	3,198
Minus debt	-1,184
Equity value	2,014

Other errors when calculating the WACC:

- Using the statutory tax rate, instead of the effective tax rate, of the levered company. The correct tax rate to use for calculating the WACC for valuing a company is the effective tax rate of the levered company in every year.

- Calculating the WACC using book values of debt and equity. The appropriate values of debt and equity are those resulting from the valuation.

3. Wrong calculation of the value of tax shields

Fernández (2002, page 506) shows different expressions for calculating the value of tax shields, all of which are frequently used and are supported by papers in the financial literature. Only two of them are correct, as shown in Fernández (2004c):

- If the company expects to increase its debt, the value of tax shields is the present value of D Ku T discounted at the required return to unlevered equity (Ku):
  VTS = PV[D Ku T; Ku]. See Fernández (2004a).

– If the company is not expected to increase its debt, the value of tax shields is: PV[D T Kd; Kd]. See Myers (1974).

Some incorrect formulae for calculating the value of tax shields are:

Harris-Pringle (1985) and Ruback (1995, 2002): PV[Ku; D T Kd]
Damodaran (1994): PV[Ku; DTKu - D (Kd- RF) (1-T)]
Practitioners: PV[Ku; DTKd - D(Kd- RF)]
Miles-Ezzell (1980): PV[Ku; D T Kd] (1+Ku)/ (1+Kd)

4. Wrong treatment of country risk

Some examples are the following:

4.1. Not considering the Country Risk, arguing that it is diversifiable.

Taken from a regulator: "It is not correct to include the country risk of an emerging country because from the perspective of global investors only systematic risk matters, and country specific events will be uncorrelated with global market movements. Therefore, country specific events will be unsystematic risk, totally uncorrelated with global market movements." According to this view, the required return to equity will be the same for a US diversified portfolio and a Bolivian diversified portfolio.

4.2. Assuming that a disaster in an emerging market will increase the calculated beta, in relation to the S&P 500, of the country's companies.

Taken from a financial consulting firm: "The occurrence of any dramatic systemic event (devaluation, end of convertibility, capital transfer controls, threats to democratic stability) that significantly raises the country risk will lead automatically to a substantial increase in the estimated beta, in relation to the S&P500, of the companies that operate in that country. The best way to estimate the beta of an emerging economy company with a U.S. stock market listing is through a regression of the return of the share on the return of a U.S. stock market index."

No. That is why, when valuing companies in emerging countries, we use the country risk, because the beta does not capture all the above-mentioned risks: devaluation, end of convertibility, capital transfer controls, threats to democratic stability...

Also, if ADRs have low liquidity (if they are traded only a few times each day and are unlikely to be traded exactly at the close of each session, which is when analysts usually take prices for calculating betas), then the calculated beta will tend towards zero, owing to the non-synchronous trading effect, which is perfectly described by Scholes and Williams (1977).

4.3. Assuming that the beta calculated from historical data captures the country risk.

Interpretation of an investment bank about the beta of a foreign company listed on the US stock market: "The question is: Does the beta calculated on the basis of the

company's share price in New York capture the different premiums for each risk? Our answer is yes, because just as the beta captures changes in the economy and the effect of leverage, it must necessarily absorb the country risk."

There are various ways of including a company's country risk component in the CAPM formula. The most common is to use the spread between the long-term dollar treasury bonds of the country in which the firm operates and long-term U.S. Treasury bonds.

5. Wrong calculation of the cash flows

5.1. The free cash flow and the equity cash flow do not accomplish $ECF = FCF + \Delta D - Int\ (1-T)$.

This equation represents the relationship between the equity cash flow and the free cash flow. It may be found in Fernández (2002, pages 42 and 401). There are many valuation reports in which, given the FCF, the debt increase (ΔD), the interest payments (Int), and the effective tax rate (T), the calculated ECF has no relation at all with the expected equity cash flows of the company (dividends plus share repurchases).

5.2. Considering an increase in the company's cash position or financial investments as an equity cash flow.

Examples of this error may be found in many valuations; and also in Damodaran (2001, page 211), who argues that "when valuing a firm, you should add the value of cash balances and near-cash investments to the value of operating assets." In several Internet companies' valuations, the analysts calculate the present values of expected cash flows and add the company's cash, even when it is well known that the company will not distribute it in the foreseeable future.

It is wrong to add all the cash because:

1. The company needs some cash to continue its operations, and
2. It is not forecasted to distribute the cash immediately

It will be correct to add the cash only if:

- The interest received on the cash were equal to the interest paid on the debt, or
- The cash will be distributed immediately, or
- The cost of debt used to calculate the WACC was the weighted average of the cost of debt and the interest received on the cash holdings. In this case, the debt used to calculate the debt to equity ratio must be debt minus cash. The cash increases must be included in the "Investments in working capital."

The value of the excess cash (cash on top of the minimum cash needed to continue operations) is lower than its book value if the interest received on the cash is lower than the interest paid on the debt. The company increases its value by distributing the excess cash to shareholders or by using it to reduce its debt, rather than keeping it.

5.3. Expected Equity Cash flows are not equal to expected dividends plus other payments to shareholders (share repurchases…).

There are several valuation reports in which the valuer computes the present value of positive Equity Cash Flows in years when the company will not distribute anything to shareholders. Also, Stowe, Robinson, Pinto, and McLeavey (2002) say that "Generally, Equity Cash Flow and dividends will differ. Equity Cash Flow recognizes value as the cash flow available to stockholders even if it is not paid out." Obviously, that is not correct, unless we assume that the amounts not paid out are reinvested and get a return equal to Ke (the required return to equity).

5.4. Forgetting balance sheet accounts that affect the cash flows. In the balance sheets, the following relation must hold every year:

> WCR + NFA = D + Ebv, where WCR = Working Capital Requirements; NFA = Net Fixed Assets; D = Book value of debt; Ebv = Book value of equity.
>
> It also holds that
> ΔWCR + ΔNFA = ΔD + ΔEbv.

There are many valuations that are wrong because the valuer did not project the balance sheets, and the increase of assets (ΔWCR + ΔNFA, which appear in the cash flow calculation) does not match the assumed increase of debt plus the assumed increase of the book value of equity.

5.5. Exaggerated optimism when forecasting the cash flows.

An example is the following valuation report about Enron Corp., produced by a recognized investment bank on July 12, 2001, when the share price was $49.

> "We view Enron as one of the best companies in the economy. There are still several misconceptions about Enron that mask the company's strong fundamentals. We therefore hosted an investor conference call on June 27 to clarify Enron's growth prospects and answer investors' questions.
>
> "We expect Enron shares to rebound sharply in the coming months. We believe that Enron shares have found their lows and will recover significantly as investor confidence in the company returns and as misconceptions about Enron dissipate. We strongly reiterate our Buy rating on the stock, with a $68 price target over the next 12 months.
>
> "Enron is a world-class company, in our view. We view Enron as one of the best companies in the economy, let alone among our group of diversified natural gas companies. We are confident in the company's ability to grow earnings 25% annually for the next five to ten years, despite its already large base. We believe that Enron investors have the unique opportunity to invest in a high growth company with improving fundamentals.
>
> "We strongly reiterate our Buy rating on the stock, with a $68 price target over the next 12 months.

Enron earning model, 1994-2005E. US$ millions except per-share data

	1994	1995	1996	1997	1998	1999	2000	2001E	2002E	2003E	2004E	2005E
Net income	438	504	568	88	686	827	896	1,563	1,939	2,536	3,348	4,376
Adjusted EPS	0.83	0.91	0.91	0.87	1.00	1.18	1.47	1.85	2.25	2.75	3.52	4.47
Dividends per share	0.38	0.41	0.43	0.46	0.48	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Book value per share	5.15	5.65	6.64	9.27	9.95	12.28	13.94	15.47	17.99	21.02	24.79	29.47

> "We recently raised our 2001 EPS estimate $0.05 to $1.85 and established a well-above consensus 2002 estimate of $2.25. We are confident in the company's ability to grow earnings 25% annually for the next five to ten years, despite its already large base."

How Enron's share price evolved after this report is well known.

5.6. Not considering cash flows resulting from future investments.

From a valuation of an edible oil company that was the leader in the Ukraine and also had strong volume and brand recognition in Russia. The company was operating at almost full capacity and had plans to invest in a new plant in Russia.

Taken from an investment bank: "From a methodological viewpoint, if this project had to be taken into account, its net present value should be assumed to be nil. The most reasonable approach would be to assume that the investment is expected to deliver a return that is equal to financial market expectations, which implies a net present value equal to zero." Taken from an expert witness in the same arbitrage: "By taking into account a future Russian plant project in the valuation, the seller of the shares would benefit from the profits generated by this new project without incurring the related risks, as he would anyway not take part in the future investment."

6. Errors when valuing seasonal companies

Wrong treatment of seasonal working capital requirements and of seasonal debt. Fernández (2003) shows that the equity value calculated using annual data without making the adjustments understates the true value by 45% if the valuation is done at the end of December, and overstates the true value by 38% if the valuation is done at the end of November. The error of adjusting only by using average debt and average working capital requirements ranges from –17.9% to 8.5%.

7. Errors in the calculation of the residual value

Inconsistent Cash flow used to calculate the value of a perpetuity. An example is the valuation of a manufacturing company performed by a financial consulting firm (see Table 8), in which expected free cash flows are discounted at the WACC rate of 12%. Lines 1 to 5 contain the calculation of the free cash flows. The residual value in 2007 is calculated assuming a residual growth of 2.5%:

Residual value in 2007 = 12,699 = 1,177 x 1.025 / (0.12 - 0.025).

The enterprise value (line 9) is the sum of the present value of the free cash flows 2003-2007 (line 7) plus the present value of the terminal value (line 8). Subtracting debt value (line 10), the financial consulting firm calculates the equity value (line 11) as $6,561 millions. It sounds all right, but the valuation contains a major error.

Table 8. Valuation of a manufacturing company performed by a financial consulting firm

line	$million	2003	2004	2005	2006	2007
1	Net Operating Profit After Taxes	500	522	533	574	616
2	Depreciation	1,125	1,197	1,270	1,306	1,342
3	Capital expenditures	-1,445	-722	-722	-361	-361
4	Investment in working capital	203	-450	-314	-399	-420
5	Free cash flow	383	547	767	1,120	1,177
6	Residual value in 2007 (WACC 12% and residual growth 2.5%)					12,699
	Present value in 2002 of free cash flows (WACC =12%):					
7	2003-2007	2,704				
8	Residual value in 2007	7,206				
9	Total EV (Enterprise Value)	9,909				
10	Minus debt	-3,348				
11	Equity value	6,561				

It is inconsistent to use the FCF of 2007 to calculate the residual value. The reason for that is that in 2007 the forecasted capital expenditures (361) are smaller than the forecasted depreciation (1,342). It is wrong to assume that this will happen in the future indefinitely: net fixed assets would be negative by 2010! Of course, in a given year, or in various years, capital expenditures may be lower than depreciation, but it is not consistent to use this in the normative cash flow used to calculate the residual value as a growing perpetuity.

The normative 2007 FCF used to calculate the residual value should be $196 million (assuming capital expenditures equal to depreciation) or less (if we assume that the net fixed assets also grow at 2.5%). Correcting this error in the valuation, Table 9 shows that the equity value is reduced to $556 million (instead of $6,561 million).

Table 9. Valuation of the manufacturing company from Table 8, adjusting the normative free cash flow and the residual value

	Normative 2007 FCF	196	
6	Residual value in 2007	2,115	= 196 x 1.025 / (0.12 - 0.025)
	Present value in 2002 of free cash flows:		
7	2003-2007	2,704	
8	Residual value in 2007	1,200	
9	Total EV (Enterprise Value)	3,904	
10	Minus debt	-3,348	
11	Equity value	556	

8. Errors when using multiples

8.1. Using the average of multiples extracted from transactions executed over a very long period of time, and/or the average of transactions multiples that have a wide dispersion.

An investment bank produced this valuation in January 2003. "Table 10 shows the multiples of recent transactions. We use the median of these multiples (6.8), as the median eliminates extremes."

Table 10. Transaction multiples in the oil business

Acquirer/Target	Date	EV/EBITDA	EV/EBIT
Bunge/Cereol	November 2002	6.3x	9.6x
Cargill/Cerestar	October 2001	12.1x	na
Land O'Lakes/Purina Mills	June 2001	4.0x	8.2x
Primor Inversiones/Mavesa	January 2001	7.5x	10.3x
Corn Product International/Arcancia CPC	October 1998	7.3x	na
Eridania Béghin-Say/American Maize products	February 1995	5.5x	8.3x
	Average	7.1x	9.1x
	Median	6.8x	9.0x

Error. The multiples come from a very long period of time: February 1995 to November 2002.

2. Dispersion of the multiples. The EV/EBITDA ranges between 4 and 12.1. Why should 6.8 (the median) be a reasonable multiple?

8.2. Using a multiple from an extraordinary transaction.

An example is the following valuation of Telecosin, performed by a consulting firm for an arbitrage. "The legitimacy of the comparable transactions method is based on the fact that financial analysts working for merchant banks, consulting firms and financial companies widely and predominantly use this method and the revenue parameter for valuing companies like Telecosin.

"In September 2000, a group of investors consisting of Dresdner Kleinwort Benson, MCH and Sibec acquired 20% of the company IP Systems for 3.6 million euros. This implies that 100% of the company was valued at 18 million euros.

"IP Systems has many features in common with Telecosin, making it a suitable point of comparison for determining the value of Telecosin. There are, however, two differences in Telecosin's favor that need to be mentioned: long experience in the market (which implies more consolidated goodwill and greater recognition by customers), and a significantly larger workforce. The following table offers a comparison of the two companies:

	IP SYSTEMS	Telecosin
Turnover 99	0.9 million euros (1 month)	2.75 million euros
Turnover 2000	10.4 million euros	6.81 million euros
Workforce	63 people	110 people
Founded in	1999	1994

"In 1999, IP Systems had a turnover of 0.9 million euros. However, the company had only started trading in November. If we extrapolate this turnover to the year as a whole, we get an annual turnover of 5.4 million. Therefore, the growth in IP System's turnover in the period 1999-2000 is 90%, lower than that of Telecosin in the same period (146%).

"The IP Systems investors valued the company with reference to the sales figure for the current year (2000), using a sales multiple of 1.7. If this same multiple (1.7) is applied to Telecosin's minimum forecasted sales for 2001 (16.8 million euros), the value of the shares of the company in December 2000 is 28.6 million."

Table 11 shows the balance sheets and P&L of Telecosin.

Table 11. Balance sheets and P&L of Telecosin, 1995-2000 (Thousand euros)

(Thousand euros)	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**
Sales	336	768	1,009	1,848	2,746	6,815
Net income	15	8	11	98	156	87
Dividends	0	0	0	0	0	0
Cash and banks	33	13	53	426	421	82
Accounts receivable	119	201	211	635	779	3,372
Inventories	0	73	20	42	150	141
Net fixed assets	59	53	50	158	235	804
TOTAL ASSETS	**212**	**340**	**334**	**1,261**	**1,586**	**4,400**
Bank debt	0	0	2	407	457	1,438
Trade creditors	100	233	102	212	204	1,619
Other creditors	47	36	146	340	558	798
Shareholders' equity	64	72	83	301	457	545
TOTAL	**212**	**340**	**334**	**1,261**	**1,586**	**4,400**

Decision of the Court of Arbitration

"A party has presented a valuation based on what is known as the comparable transactions method. Some securities firms and investment banks used this method for a period of approximately two years (between 1998 and 2000). There was a clear reason for using it then: it was impossible to explain the exorbitant prices paid for many new economy firms using the methods in general use up until then. The comparable transactions method never had any theoretical underpinnings. And

certainly, after the summer or autumn of 2000, it was totally discredited. This method is therefore not worth considering.

"We are left, therefore, with the discounted cash flow method, which is the most widely accepted method of firm valuation, and the one that the Panel of Arbitrators considers most appropriate in this case. We value the shares of Telecosin at 2.4 million euros."

8.3. Using ad hoc valuation multiples that go against common sense

An example is the valuation of Terra's shares performed by a Euro American bank in April 2000 (see Table 12), when Terra's share price was 73.8 euros. As the valuation given by Table 12 is 104 euros per share, the bank advised its customers to buy Terra shares.

The valuation is based on the 15 largest Internet companies in USA. The first column gives the price per share, the second column the number of shares outstanding, and the third column the companies' capitalization in million dollars. When the net debt is added to the capitalization, what the bank calls enterprise value (EV) is obtained. Thus, the sum of the enterprise values of the 15 largest Internet companies in USA was 278.1 billion dollars. The Euro American bank's analyst then divided this quantity by the number of inhabitants in USA, which he estimated to be 273 million, obtaining the EV per capita in USA: 1,019 dollars.

At the bottom of Table 12, the analyst divided Terra's market into 3 geographical areas: Spain, Hispanic America (American citizens who are Spanish speakers), and Latin America. Column [1] shows the gross national product per capita in each of these three geographical areas, and column [2] shows the percentage they represent with respect to the gross national product per capita in USA ($32,328). Column [3] is the result obtained by multiplying the EV per capita in USA (1,019 dollars) by the ratio between the gross national product per capita in each of the three geographical areas and the North American gross national product per capita (column [2]). The analyst then multiplied column [3] by the number of inhabitants in each geographical area (column [4]) and by Terra's estimated market share in each of these markets (column [5]), to obtain Terra's value in each of these geographical areas (column [6]). Adding the three amounts in column [6], he arrived at the value for Terra: 27.117 billion dollars. After subtracting the net debt from this amount, he obtained Terra's implicit capitalization: 27.642 billion dollars. By dividing this quantity by the number of Terra shares (280 million) and by the euro exchange rate, the analyst obtained the value of the Terra share: 104 euros per share.

Doesn't this valuation seem surprising to the reader? We can propose another way of getting the figure of 104 dollars per share: The value of the Terra share is twice the age of Manolo Gómez's mother-in-law, who is 52. We chose Manolo because he lives near Terra's corporate headquarters. Of course, this valuation is absurd, but it is about as rigorous as the one given in Table 12. As the saying goes, "the blind man dreamed he saw, and he dreamed what he wanted to see."[1]

Terra traded at 11 euros at the end of 2000, at 9 euros at the end of 2001, and was trading between 4 and 5.4 euros in the first six months of 2003.

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[1] Other valuations of Internet companies using esoteric multiples may be seen in Fernández (2002, chapter 12).

Table 12. Valuation of Terra performed by a Euro American bank on 7 April 2000

EV (enterprise value) of the 15 largest information hubs in USA:					
AOL	146,843	Go Networks	3,482	Ask Jeeves	1,896
Yahoo!	81,976	LookSmart	3,243	NBC Interactive	1,482
Infospace	14,097	The Go2Net	2,396	About.com	899
Excite@Home	10,861	Earthlink	2,283	Juno	442
Lycos	6,142	GoTo.com	2,003	TheGlobe.com	100
Sum of the enterprise value of the 15 largest information hubs in USA					278,145
No. inhabitants (million) 273					
EV per capita (US$)1,019					
GNP per capita in the US (US$)					32,328

	GNP per capita (US$)	GNP per capita vs. USA (%)	**Adjusted EV per capita (US$)**	Million inhabitants	Terra market share (%)	**Value**
	[1]	[2]	[3]	[4]	[5]	[6]
Spain	17,207	53%	542	39	30%	6,345
Hispanic America	16,164	50%	509	30	5%	764
Latin America	7,513	23%	237	338	25%	20,008
Average	***9,080***	28%	***286***	***407***	23%	
Enterprise Value of Terra ($ million)					**27,117**	
Net debt ($ million)					-525	
Implicit capitalization ($ million)					27,642	

Million shares: 280	Dollar/euro exchange rate: 0.94875	**Price per share (euros)**	**104**

9. Time-value inconsistencies

For example, assuming that the equity value will be constant in the future. Taken from an analyst's valuation report: "As we do not know how the equity value of the company will evolve, a good approximation is to assume that the equity value will remain constant over the following five years." That is not correct. Fernández (2002, pages 401 and 497) shows that the relationship between the equity value of different years is: Et = Et-1 (1+Ket) – ECFt. Note that the equity value is constant (Et = Et-1) only if ECFt = Et-1 Ket. That only happens in no-growth (constant) perpetuities.

The relationship between the enterprise value of different years is: Et+Dt = (Et-1+Dt-1) (1+WACCt) – FCFt.

10. Including the value of real options that have no economic meaning

An example: Table 13 contains the net present value calculation of a project for a new plant in Brazil for a supplier of automotive interior systems to most of the major car

assemblers. Initial outlays were $38 million. The project involved supplying components for 500,000 cars the first year, and 850,000 cars the following years. The net present value of the project (given the cost of the new plant and the expected free cash flows), using a WACC of 14.95%, is negative: -$ 7.98 million.

Table 13. Net present value calculation of a project for a new plant in Brazil. WACC = 14.95%

($ million) in nominal terms	0	1	2	3	4	5	Salvage value
FCF	-37.9	3.5	12.6	10.7	8.5	7.1	3.8
NPV	-7.98						

However, the valuer argued that the owner of the plant had additional options that were not included in the net present value calculation:

- Options coming from the possibility of winning new supply contracts during the life of the plant (growth options, valued as three European options with strike prices of $5.6, $0.4 and $0.085 million)

- Option to renew initial supply contracts at their expiration date (prolongation option, valued as a European option with strike price of $42.7 million). The salvage value of the project is neither the value of its contract renewal nor the liquidation price of its assets, but the higher of the two.

- Flexibility options: possibility of adapting project costs to the growth of sales.

- Abandonment option: possibility of abandoning the investment prior to the end of its life (valued as an American put option on the future cash flow stream, with strike price equal to the project's salvage value and maturity equal to the project's life).

Valuing the options and the project, the valuer decided that the expanded net present value (value of the plant taking into account the real options embedded in the investment) was as shown in Table 14. The valuer concluded: "Taking the real options into account reveals a significant positive expanded NPV for various assumptions about the future evolution of the state variable (number of cars produced and assembled in Brazil), and therefore confirms the optimality of the investment decision."

Table 14. Expanded net present value of a project for a new plant in Brazil, as a function of the drift rate and volatility. Volatility is the standard deviation of the number of cars produced and assembled in Brazil. Drift rate is the expected growth of the number of cars produced and assembled in Brazil.

	Drift rate		
Volatility	0%	7%	15%
7%	2.4	7.5	15.2
13%	2.5	7.6	15.2
20%	2.8	7.2	13.6

Adding options increases the value of any company. But before we add the value of any option, we must answer the following questions: Do the options belong to the company? Does the specification of the options (which depend almost exclusively on the number of cars produced and assembled in Brazil) describe them accurately?

11. Arguing that different discounted cash flow methods yield different valuations.

All methods always give the same value, as is shown in chapters 17 and 21 of Fernández (2002). This result is logical, since all the methods analyze the same reality under the same hypotheses; they differ only in the cash flows taken as the starting point for the valuation.

12. Asserting that "the valuation is a scientific fact, not an opinion."

This error arises from forgetting that the value resulting from any valuation is always contingent on a set of expectations (about the future of the company, the industry, the country and the world economy) and the valuer's appraisal of the company's risk. A valuation has little to do with science: it is always an opinion.

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